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Recognizing that many Western institutions of higher education are developing management information systems, the Western Interstate Commission for Higher Education (WICHE) Management Information Systems (MIS) Program is proposing the standardization of data elements in the data bases of these independent systems to develop common programs for data analysis and to facilitate the rapid exchange and processing of similar information from several institutional sources. The purpose of this technical report is to respond to the question: How can management information systems be developed which will respond to the unique needs of the individual institutions and at the same time be sufficiently compatible to permit valid interinstitutional information comparisons? WICHE MIS program objectives involve the development of exchange formulas and models, beginning with models that will facilitate the interinstitutional exchange of various types of unit cost data. These models will be used to identify data elements to be specified in a standard data element dictionary. A supplementary objective is to develop standard codes, field formats, and file structures for data storage, and present them in manuals that will explain how a total information system should be developed, so that small institutions with limited analytical research and computer capabilities may develop management information systems. The report explains the WICHE MIS concept of compatibility and defines system components for the derivation of certain data. (WM)

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COMPATIBLE MANAGEMENT INFORMATION SYSTEMS

A technical report concerning the concepts underlying compatibility in the WICHE Management Information Systems Program

Technical Report 1

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Management Information Systems Program
Western Interstate Commission for Higher Education

COMPATIBLE MANAGEMENT INFORMATION SYSTEMS

TECHNICAL REPORT 1

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COMPATIBLE MANAGEMENT INFORMATION SYSTEMS

A Technical Report Concerning
The Concepts Underlying Compatibility
in the WICHE Management Information Systems
Program

Technical Report 1

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COMPATIBLE MANAGEMENT INFORMATION SYSTEMS

The Concepts Underlying Compatibility in the WICHE Management Information Systems Program

Almost every institution of higher education in the West is developing some type of management information system. There is widespread agreement that these independently developing systems should be compatible. However, the amount of effort required to coordinate the development of the many systems within the many diversely-constituted institutions has thus far prevented the accomplishment of this desired goal. In addition, some administrators fear that creation of compatible systems may bring about inflexibility and undue homogeneity in the planning and operation of institutions. These fears may be allayed by the knowledge that management information systems may assist the decision-maker but they cannot in fact make decisions for him.

The WICHE Management Information Systems (MIS) Program proposes to encourage the development of management information systems within higher education institutions which will, at the same time, be sufficiently individualized to serve the unique needs of the respective institutions, and sufficiently compatible to allow valid inter-institutional data comparisons. The WICHE Management Information Systems will also promote efficient reporting to state and federal governments.

How can management information systems be developed which will meet the unique needs of the individual institutions and at the same time be sufficiently compatible to permit valid inter-institutional information comparisons? The purpose of this paper is to respond to this important question.

Compatibility: Concepts and Definitions

Clarification of the concept of compatibility must be the first step in any explanation of the WICHE MIS Program and its purposes. The pieces of data which are collected by means of a management information system are referred to as data elements. The discrete data elements used in any two systems must be identical if the two systems are to be compatible.

Data elements may be thought of as discrete, irreducible items. Two data elements may be combined in some mathematical manner to produce a derived piece of data, but a pure data element cannot, itself, be divided into smaller components. To illustrate: a student name is a discrete data element; a credit hour is a discrete data element; but an FTE student is a derived piece of information.

The array of data elements which are collected and filed by a management information system comprise the data base of that system. When two or more data elements from a system's data base are used to derive a piece of information, it is valid to compare that piece of derived information to a similar piece of information derived from another data base, only if both were derived from identical data elements which were employed during the derivation process in precisely the same way. Thus, compatibility of management information systems depends not only on the collection of identical data elements to comprise the data bases of the systems, but also on the standardization of the definitions and formulas used to derive comparable pieces of information from the identical elements.

Schematic explanations of the essential aspects of compatible management information systems are presented in Figures 1-3 on the following page:

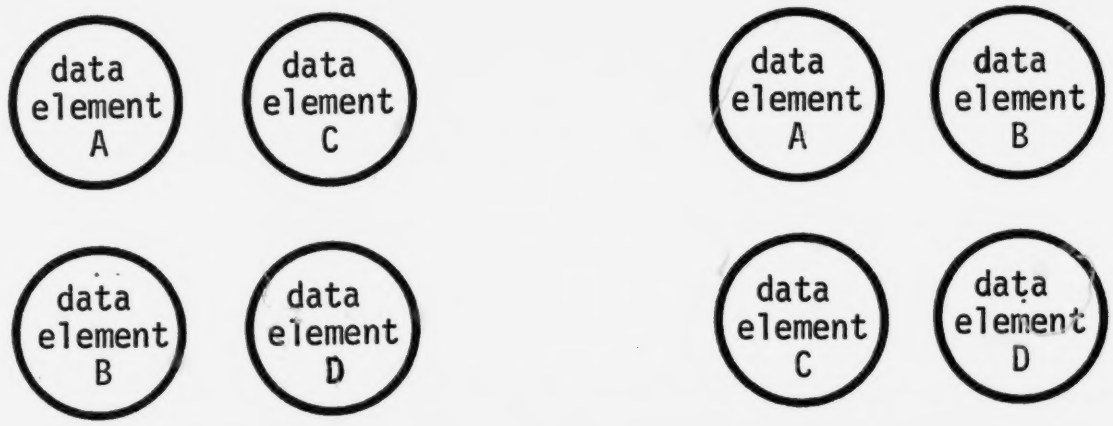

Figure 1: Representation of two identical data bases which make compatibility of the two respective management information systems possible.

Data Base I

$$\frac{A + B}{C} = X$$

Data Base II

$$\frac{A + B}{C} = X$$

Figure 2: Elements from two compatible data bases used to derive two compatible pieces of information.

Data Base I

$$\frac{A + B}{C} = X$$

Data Base II

$$\frac{A + D}{C} = X_1$$

Figure 3: Elements from two compatible data bases used to derive two similar but not compatible pieces of information.

Given compatible data bases it is feasible for institutions to derive information in a manner compatible with other institutions and therefore make valid data comparisons, and also derive similar information in slightly different (incompatible) ways in order to meet unique institutional needs.

For Example: From a common compatible data base,

A	B	C
D	E	F

an institution may compute its enrollment in accordance with a Full-Time Equivalent (FTE) student measure unique to its own needs by processing the data elements according to its own conventions --

$$\text{Unique FTE} = f(A, B, F), \text{ e.g., FTE} = \frac{A + B}{F}$$

or may compute its enrollment in accordance with a regional standard FTE for comparison with other institutions by processing the data elements according to standard conventions --

$$\text{Standard FTE} = f(A, B, C) \text{ e.g., FTE} = \frac{A + B}{C}$$

We have established that the degree of compatibility between any two management systems is determined by the degree of agreement concerning:

1. the data elements included in the data bases of the two systems;
2. the definitions (must be identical) of those data elements; and
3. the standardization of the use of the data elements in deriving information to be compared.

It has also been demonstrated that management information systems may concurrently provide compatible information for comparisons and uniquely derived information to serve unique institutional needs.

The WICHE MIS Program seeks compatibility with regard to the data elements to be included in the data bases and with regard to the definitions of those elements and their use in deriving information for exchange and comparison.

To ensure standardization of the use of the data elements in deriving exchange information, WICHE proposes to develop standard definitions and formulas (referred to as standard analytical models).

Institutions will use these standard definitions and formulas, or models, to make their respective information sets available in compatible form to other institutions.

The WICHE MIS Program objectives do not now require or include compatibility in coding, field formats, or file structures. Accordingly, participation in the program will not require the adoption of prescribed data processing procedures or specified equipment. However, going beyond the minimum essentials of compatibility, the ease of exchange of information for comparative purposes may be further enhanced by voluntary agreements among cooperating institutions with regard to use of (1) standardized data processing codes for data elements; (2) prescribed field formats; and (3) prescribed file structures. Such agreements will permit the development of common programs for analysis of data and will facilitate rapid exchange and processing of data from several institutional sources. WICHE may, if funds become available, develop suggested codes, field formats, and file structures as examples to those institutions in need of such assistance in the development of their information systems.

Most institutions, while using the standard data element bases, will not be using standard codes and file structures for the storage of data. In order to use data stored according to their unique codes and file structures in the standard definitions and formulas or models described earlier, it will be necessary for codes and file structures to be converted (by means of an interface program) to a form acceptable to the standard models. The procedure used to convert or restructure the codes and file structures is called transformation through conversion programs. Those institutions that adopt the codes, field formats, and file structures used by WICHE would, of course, not have to use conversion programs

because their data will already be structured appropriately for use in the standard models.

The new language of systems analysis will become more familiar to the education community as its use becomes more widespread.

Specific WICHE MIS Program Objectives Related to Compatibility

Compatibility Objective I

Develop an array of WICHE Management Information Exchange Formulas and Models beginning initially with those models which will facilitate the exchange of various types of unit cost information between institutions.

These WICHE Exchange Formulas and Models may include but not be limited to:

a. Standardized procedures for determining student FTE.

b. Standardized procedures for determining faculty FTE.

c. Standardized procedures for determining unit costs by level of student, by level of course, and by field of study.

d. A WICHE Program Budget Structure.

e. A WICHE Resource Requirements Prediction Model.

f. A WICHE Student Flow Model.

These models will be used to identify data elements to be specified in a WICHE Standard Data Element Dictionary. By the common use of these WICHE Exchange Models and conversion programs, institutions will be able to exchange information that is comparable. The data elements which serve as inputs for these models will be specified, and the model subroutines and operations will be prescribed. The models will be empirically tested until operable.

Compatibility Objective II

Develop a WICHE Standard Data Element Dictionary.

This dictionary will:

a. specify the name of each data element;

b. define each data element;

c. indicate, for each of the WICHE Exchange Models and for the HEGIS Report, whether or not the element in question is a part of the common data base required for that model or report.

Compatibility Objective III

A supplementary objective of the WICHE MIS Program which will be implemented as additional funds become available, is to:

Develop standard codes, field formats, and file structures for storage of data.

Manuals will be developed setting forth these codes, formats, and file structures and explaining how a total information system should be developed and coordinated within an institution.

Implementation of Objective III will greatly increase the benefits derived from the WICHE MIS Program, for it is the presentation of these instructional manuals which will make it possible for the numerous small institutions with limited analytical research and computer capabilities to develop management information systems. No institution will ever be required to adopt a WICHE prescribed system, but the system will be readily available to all who seek it as a guide in the development of their own systems.